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the history, religion, and literature of the ancient monarchies were more and more clearly elucidated. The decipherment of the Sumerian and Vannic languages followed with the excavations and explorations of the period between 1872 and 1900.

The new material, much of which has been gathered by the University of Pennsylvania, has not yet been fully exploited, but a vast amount of it has been interpreted, sufficient to give an elaborate picture of Assyrian and Babylonian history, civilisation, culture, religion, and modes of life. This Dr. Rogers has attempted to do in two large volumes, the interest of which may be gathered from the foregoing synopsis of a part only, and from the fact that the work, although written last year, is now in its second edition. μ.

LEHRBUCH DER PHYSIOLOGIE DES MENSCHEN. Von *G. von Bunge*, Professor in Basel. Erster Band: Sinne, Nerven, Muskeln, Fortpflanzung, in Achtundzwanzig Vorträgen. Mit 67 Abbildungen im Text und 2 Tafeln. Leipzig: Verlag von F. C. W. Vogel. 1901. Pages, viii, 381. Price, 10 Marks.

A work on human physiology by the distinguished professor of that branch in the University of Basel, Switzerland, will be welcomed on many sides. Not only has Professor Bunge displayed in his professional activity a wide acquaintance with physical and chemical science, but he has also come prominently before the scientific public as the representative of a new species of vitalism in biology. The old doctrine of vital or hyper-mechanical force which dominated the eighteenth century and still lingered in the thought of Johannes Müller, the greatest physiologist of history, has found its reviviscence in the last few decades in the persons of many eminent modern inquirers; and it has, in the variations which the modern scientific point of view has imposed upon it, been joyously received, and put to the most varied religious and teleological uses, by mystics, reactionaries, and devotees of esotericism in general, as well as by earnest religious thinkers. Most pronounced in the resumption of the old vitalistic view have been the botanists Hanstein and Kerner von Marilaun, and the pathologist Rindfleisch. The neo-vitalism of Bunge, however, is more philosophically established and more scientifically grounded than the majority of these vagaries, and it has, in its fundamental principles at least, much support from philosophical quarters. It must be noted, nevertheless, that the tendency of science at the present moment is in the opposite direction, and that the recent important discovery of mechanical and physico-chemical analogies to vital phenomena have rather weakened than strengthened Bunge's position in its full extent. As for Bunge himself, he openly accepts the tenets of the ancient vitalistic creed when he says in his *Physiological and Pathological Chemistry* (1889): "I must emphatically differ with you if you think you can refute vitalism by saying that there are no other factors active in living beings than the forces and materials of inanimate nature alone." On the other hand, it appears that Bunge's vitalism is nothing more than the expression of his philosophy of subjective idealism, which holds that it is a reversal of the true order of things to explain psychi-

cal processes by the mechanics of atoms. Bunge says, in the work before quoted: "The science of vitalism is simply the adoption of the only genuine and correct method of scientific inquiry, which is that of starting from the known or inner world, and attempting to explain the unknown or outer world." In other words, his vitalism is simply a statement of the fact that it is impossible to resolve psychical processes by the physics and chemistry of matter. And in doing so, Bunge sets up the old dualistic dogma of a contrariety between the living and the lifeless, between unsouled and ensouled nature. This has led him to the assumption of the principle of the eternity of life in the universe, analogous to the physical law of the eternity of matter and energy. Since the speculations which have led him to this conclusion are interesting, however weak and unconvincing they may seem to positive and more critically trained minds, we shall give a brief synopsis of them, and of the scientific grounds on which they rest.

The question of whether a living cell can be built up from dead matter, whether spontaneous generation or abiogenesis is possible, cannot be decided in the present state of our knowledge. Its possibility must at least be admitted even though the experiments to establish it have turned out negatively, for we can never fulfil all the conceivable conditions of such a process. Yet, while all experiments have hitherto proved futile, the majority of biologists have concluded, from the fact that our earth was once a fiery mass like the sun of to-day from which it separated, that life could not possibly have existed upon it in the beginning, and that there must have been a period of time at which the first cell was formed from inanimate matter.

Now, Bunge believes,—and the grounds of his belief will have different weight with different minds,—that this doctrine was greatly invalidated by the considerations advanced by the German physician Richter (1808–1876), a professor of medicine in Dresden. Richter's theory is well known to scientists, and is not in the best repute in all quarters. Richter maintains that it was possible after the earth had cooled, for the first living cell to have reached it from some other heavenly body. His arguments are that the universe is infinite in time and space; it never began and will never cease. Matter and energy are indestructible. The sole thing that incessantly changes is form. Space is filled with originating, with matured, and with dying celestial bodies, where by "matured" is understood such as are capable of sustaining organic life. Consequently the existence of organic life in the universe must be held to be universal. It has existed from all eternity, has propagated itself in organised form, not as a mysterious primordial viscous slime, but as living organisms, as cells, or as individuals composed of cells. *Omne vivum ab æternitate e cellula!*

This disposes of the question of the origin of the first organisms, but granting that such have always existed in the world, how could they possibly have found lodgment upon this or that particular heavenly body, which, from having been uninhabitable, has become habitable. Richter answers: "Directly out of space."

Countless masses of minute substances are hovering in space, from the tenuous tails of comets to the meteoric stones which incandesce in our atmosphere, and sometimes fall to the earth. Remnants of organic substances (carbon) have been found in these. The question whether these organic substances before being destroyed by the incandescence of the meteor were composed of formless primordial slime or of formed organised structures, is to be answered in favor of the latter; for we have an analogue of the occurrence in our own atmosphere. If air be filtered through cotton, microscopic organic bodies will invariably be found in it. The equatorial winds carry great quantities of infusorial dust from Africa and South America, high over the Alps and the Pyrenees, to central Europe. The snow of the Alps may sometimes be seen covered with red infusoria. But if microscopic organisms hover so high in the atmosphere of the earth, and consequently equally high in the atmosphere of any other inhabited heavenly body, it would be quite easy for them to be attracted into space by passing comets or aerolites, and to be subsequently deposited upon another habitable world, and there spontaneously developed into higher forms. So far, Richter.

Two eminent physicists, Helmholtz and Lord Kelvin, have also tentatively admitted the possibility of the cosmic origin of life. The main objection to this theory is the low temperature of cosmic space, namely -273°C. , which is such that whether the germs clung to meteoric stones or hovered free in the ether, they would be totally destroyed by the cold. Bunge remarks in this connexion that it is to be remembered that the very simplest organisms, especially spores, can endure very low temperatures. Pictet and Yung subjected bacteria to a temperature of -130°C. , and found that some species remained alive even at this low temperature. "Why," Bunge asks, "should not spores exist capable of surviving the journey through the frigid regions of space?" Another objection is that, granting that organic germs might accidentally escape the destruction of their ancestral planets, they could not possibly escape destruction from the heat generated by the passage through the terrestrial atmosphere of the meteorites to which they cling.

It would seem to be asking a great deal of organic germs that they should be able to survive temperatures ranging from absolute zero to that required to volatilise all known metals; but neither Helmholtz nor Professor Bunge is disconcerted by this astonishing display of powers of endurance. Helmholtz contends that the larger meteoric stones are heated only in their outer layers in their passage through the earth's atmosphere, and that germs might lie hidden in the interstices of the interiors; or they might be blown off by the rush of the air before the meteor is ignited; while as for their escape from destruction from the possible annihilation of two colliding planets, Lord Kelvin has shown that the first consequences of such a collision would be mechanical movements only, and that heat could not be produced until these mechanical movements were destroyed by friction,—which might take hours or days, and would consequently not interfere with the escape into space of planetary fragments broken off at the outset. And, as for the de-

struction of the germs by the heat generated in the earth's atmosphere, Professor Bunge points to the new experiments which show that certain spores are capable of enduring a temperature of from 110 to 140 degrees Centigrade.

To sum up, in view of the fact that the mystery of primitive generation still remains unsolved, Professor Bunge is fain to conclude that there is no reason whatever for assuming that organised life ever originated on our planet, that the possibility must be admitted that living cells never sprang from inanimate matter, but have been endowed with life eternally. The notion of life's being limited either in space or time is, he thinks, but the monstrous product of human limitations.

Such is a specimen of the character of Professor Bunge's book. It embraces the widest interests, philosophical as well as scientific, and when not concerned with Professor Bunge's special vitalistic point of view, is of course less speculative. The lectures are historical as well as expository, one of the most interesting of them being devoted to placing the achievements of Gall in the right light; persons in whose minds Gall is always associated with phrenologic extravagances should read this chapter. The lectures on heredity, propagation, animal electricity, hypnotism, sleep, etc., are also interesting from a broad point of view. The other lectures treat in a very simple and intelligible manner of the usual subjects of physiological text-books, such as the specific energies, the senses, the physiology of the brain, etc., etc. That Professor Bunge does not omit in some cases to strike even a religious note, may be gathered from the following quotation which ends his reflexions on the nature of propagation, individual and racial, and on the continuity of life:

"Weismann enunciated the doctrine that unicellular organisms have life immortal, for the reason that it can never be said after division which cell is the daughter cell and which the mother; each is as old as organic life itself. And the same is true of the highest organisms; each cell of a body has lived forever, and no cell, whether spermatozoic or ovarian, which has separated from the other cells, is older than any that has remained behind. Each cell has the right to say: 'I am the cell primordial.'—We live forever. And this is true even of those who have no direct descendants; they are one, by collateral lines, with all the coming generations. Indeed, the direct descendants of the great majority of men die out after a few generations.

"The future generations are we ourselves. We continue to live in those that come after us. Never has any religion, as the physiologist Victor Hensen has remarked, given adequate expression to this idea. It will constitute the foundation of every religion and ethics of the future. All the good that we have done in life redounds to our own advantage. And so even selfishness is forced into the service of unselfishness; all motives work in concert for the perfection and ennoblement of life. Even death has been robbed of its sting: the death of an individual annihilates nothing of life. Individuals perish, millions and millions

"each second. But life ceases never a moment. What does nature care for the individual? What is the significance of the continuity of individual consciousness? We forget the old pains. We awaken in new forms to new hopes and new battles. Spring of eternal youth, immortality of life perennial, joyance never-ending and ever-renewed!" μ.

GUSTAV THEODOR FECHNER. Rede zur Feier seines hundertjährigen Geburtstages gehalten. Von *Wilhelm Wundt*. Mit Beilagen und einer Abbildung des Fechner-Denkmal. Leipzig: Verlag von Wilhelm Engelmann. 1901. Pages, 92. Price, 2 marks.

It is unnecessary for us to recall in full the details of the life and career of Gustav Theodor Fechner. Let it suffice to give Wundt's views of the philosophical standing of this great inquirer and thinker, founder of modern experimental psychology, and reviver of the *Naturphilosophie* of Schelling, and to point out the dominant notes of his career.

Fechner was primarily a natural inquirer, his departments having been physics, chemistry, and general medicine. He was the translator, compiler, and editor of many text-books in these different branches, and subsequently an author of philosophical, ethical, and mystical writings. He was first concerned altogether with the solution of concrete problems, and it was through the methodology involved in his exact scientific labors that his attention was directed to philosophy. This philosophy was half humorously and half seriously expounded in treatises bearing the titles of (1) *The Comparative Anatomy of Angels* (1825), the *Booklet of Life and Death* (1835), *Nana, or the Psychic Life of Plants* (1848), the *Zend-Avesta* (1851), etc., etc.; it being important to note in this connexion that Fechner's epoch-making works on *Psychophysics* appeared subsequently to his mystical philosophical writings.

The view that not only men and animals, but also plants, the earth itself, the planets and the fixed stars, are ensouled beings, is shared by Fechner's system in common with many other imaginative philosophical constructions, but in his case it may be shown to be an independent, intellectual creation, and its scientific justification stands on an entirely different footing from that of the ancient, mythological systems. Fechner was acquainted with Schelling, he had read parts of Oken, but whatever impulse he may have received from their speculations, his own had always been carried on in connexion with the newer and more critical development of science. The scientific discoveries of the time of Schelling and Oken were tremendous, but the philosophical interpretation of these results had made so little advancement, and the critical attitude of the mind generally had been so slightly developed, that Schelling and Oken might well be pardoned for their indulgence in fantastic speculations and for their having produced so little of lasting value. Fechner, on the other hand, had the advantage of a more exact science, of a more critical scientific philosophy, and consequently his conception of the world, poet-